

Asthma, rhinitis and eczema in Maltese 13–15 year-old schoolchildren — prevalence, severity and associated factors [ISAAC]

S. MONTEFORT, H. M. LENICKER*, S. CARUNA, H. AGIUS MUSCAT†

Departments of Medicine, *Paediatrics and †Health Information, St. Luke's Hospital, Malta

Summary

Background Allergic conditions, especially asthma, seem to be increasingly common the world over. The International Study of Asthma and Allergies in Childhood [ISAAC] was the first worldwide study carried out with standardized questionnaires in order to create a reliable global map of childhood allergy.

Objectives The Maltese Islands were one of the centres participating in this study and in this paper the data obtained from 4184 13–15 year olds from 22 state and three private schools [88.7% response rate], and also data obtained from some added 'local' questions addressed to the same children, are included. in order to evaluate the problem of allergic conditions in Maltese schoolchildren.

Results 27.9% of the participants were wheezers 'ever' while 16% were current wheezers. Of the latter children 15.1% were experiencing nocturnal wheezing at least once a week and 22% had a wheezing episode severe enough to limit speech. Nasal problems were present in 52.7% of these teenagers and 47.4% of all respondents persisted with these symptoms up to the year of answering the questionnaire. Hayfever had been diagnosed in 32.3% of all the children. 12.8% of respondents had a recurring itchy rash suggestive of eczema for at least 6 months of their lives and 10% had it currently. This was slightly lower than the global mean, unlike the case of wheezing, which in Malta was more common than the world average, and rhinitis, for which we had the second highest cumulative prevalence rate in the world. Multiple variables such as gender, smoking, family history of atopy, pets, soft furnishings and living in busy roads affected the prevalence and severity of the allergic conditions studied.

Conclusions Allergic conditions are very common in Maltese schoolchildren and are causing a lot of hardship to these same youngsters. The results of this study should serve as a stimulus to try and decrease this suffering through better management of these conditions, measures to control possible detrimental factors and further research on asthma, allergic rhinitis and eczema.

Keywords: asthma, rhinitis, eczema, childhood, Maltese

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Introduction

There is increasing evidence that the prevalence of asthma and other allergic conditions such as allergic rhinitis and eczema is increasing worldwide [1–3]. This

fact has far-reaching implications in terms of the quality of life of the people affected, the mortality from asthma and the direct medical and indirect social costs on the country's economy. Childhood asthma is amongst the most common conditions causing hardship to people in the prime of life with short- and long-term effects on the physical and psychological well-being of the affected individual and his family.

Correspondence: Stephen Montefort, 'Belvedere', J.Howard Str., San Pawl tat-Targa, NXR 06, Malta.

Many asthma prevalence studies have been conducted in various parts of the world but as these have rarely been carried out in a standardized manner, one could not reliably compare results between different countries or indeed between different parts of the same country. This has led to an international study on the prevalence and severity of childhood asthma and other allergic disorders [ISAAC] being set up [4]. In phase I of the study, standardized questionnaires were developed and distributed to two age-groups of children in these various participating countries.

In this paper we report our analysis of the ISAAC phase I written questionnaire survey of 13–15-year-old schoolchildren in the Maltese Islands. We have also analysed the answers to some additional questions regarding factors which could possibly contribute to the prevalence and severity of these childrens' allergic conditions.

The Maltese Islands are an archipelago in the middle of the Mediterranean [14° east latitude and 35° north latitude], with two main populated islands – Malta and Gozo. Malta has an area of 246 km² and a population of 330 000 while Gozo is even smaller with an area of 67 km² and a population of approximately of 30 000 people. These densely populated small islands are inhabited almost solely by Maltese people and thus there are no other ethnic groups of note.

Methods

Questionnaires

The ISAAC standard questionnaire consisted of three main sections, each involving questions relating to the prevalence and severity of wheezing, rhinitis and eczema respectively (appendix 1). The questions on asthma concentrated mainly on past and current wheezing episodes, frequency of wheezing attacks, sleep disturbance, acute severe wheezing episodes, exercise-induced wheezing, night-time cough which was unrelated to infection and finally a diagnosis of asthma. The core questionnaires for rhinitis and eczema followed a similar format. These questionnaires were validated in previous studies [5]. As the great majority of Maltese children speak English fluently, they were given a choice of either answering a Maltese or English version of the questionnaire. At the end of the standard questionnaire, we opted to add a separate list of questions regarding factors which were of 'local' interest and which could possibly contribute to the situation of allergic conditions in Malta. These questions related to a family history of allergy, personal and passive smoking, presence of soft furnishings in the bedroom and pets in the house, and the amount of traffic in the street where the children lived.

Sampling and data collection

Twenty-five schools from Malta and Gozo were randomly chosen, 22 were state schools while three were private schools. The schools were situated all over the islands and included junior lyceums, secondary schools, trade schools and opportunity centres. The selected age group for the international arm of the ISAAC study was 13–14 years but for the national analysis our centre decided to analyse all the data obtained and thus our figures included the data from a 13–15-year-old age bracket. The total number of children within the two school years which included the biggest number of 13–14-year-olds was 4718. This constituted over 50% of children within this age-group attending state and private schools (approximately 9100) in the Maltese Islands. The sampling frame from each school ranged from 22 to 505 children. When all children in the chosen classes were included in the calculation, the total response rate was 88.7% as 4184 children participated in the study. The great majority of children were 13–14 year olds while a good number were 15 year olds. Less than 50 children were outside this age range; 53.7% of all the participants were girls; and 271 of the respondents attended private schools.

It was attempted that as many data sets as possible were collected from the children who were randomly chosen to participate in the study. Extra sessions to answer the questionnaires were organized for children who were absent on the first visit to the school. As the season of the year may influence the reported prevalence of allergic conditions it was felt that at least half of the study population should be investigated before the start of the main pollen season. The data for this study were collected between January and July 1995 and continued between October and November of the same year. In this way the study was carried out through different seasons and more than half of the study was finished before the main pollen season in the April–May period.

Consent

The parents of these children were sent an information sheet about the study and were asked to sign a special section of this sheet if they refused to allow their children to participate, and return the sheet to the school headmaster. A contact telephone number was available for the parents to contact in case of any queries they might have about the study.

Ethical approval

The study was approved by the Ethics Committee of the Malta Medical Council.

Table 1. Responses for core questions on asthma, rhinitis and eczema

	Total (%)	Boys (%)	Girls (%)	
Responses for asthma				
Wheeze 'ever'	27.9	29.3	26.8	
Wheeze in last 12 months	16	15.8	16.1	
Diagnosed asthma	11.1	10.9	11.3	
Exercise-induced wheeze	20.6	21.3	19.9	
Nocturnal cough	31.8	27.6	35.5	$P < 0.0001$
Response for rhinitis				
Nasal problem 'ever'	52.7	49.2	55.7	$P < 0.0001$
Nasal problem last 12 months	47.4	42.6	51.5	
Diagnosed rhinitis	32.3	27.3	36.3	$P < 0.001$
Associated itchy eyes	28.9	22.1	34.9	$P < 0.0001$
Responses for eczema				
Recurrent rash 'ever'	12.8	10.9	14.4	$P < 0.001$
Recurrent rash last 12 months	10.1	8.4	11.5	$P < 0.001$
Recurrent rash typical eczema distribution	7.7	6.5	8.8	
Diagnosed eczema	8.8	2.4	14.2	$P < 0.001$

Statistical analysis

The data from the questionnaires were double-entered by data input clerks into Epi-info, a computer program for the capture and processing of epidemiological data. The datasets were then validated and consolidated by a single data manager. Results were analysed and tested for statistical significance through the calculation of χ^2 values and odds ratios. Student's *t*-test for the difference between rates and Fisher's exact test were used when appropriate.

Results

Responses to questionnaire on wheezing (Tables 1 and 2)

Of all respondents, 27.9% had wheezed sometime in their lives while 16% were still wheezing in the last 12 months. Although there was no difference in these two prevalence rates between sexes, 60.2% of the female wheezers 'ever' were current wheezers compared with the 54% in the case of males ($P < 0.05$). Of current wheezers, 68% had one to three wheezing attacks in the past 12 months while 19.7% had four to 12 and 8.5% had more than 12 such episodes. The sleep of 57.8% of the current wheezers was never disturbed by wheezing, but 25.3% had nocturnal symptoms less than one night per week and 15.1% were awakened by wheezing one or more nights a week; 22% of children experiencing wheezing in the past 12 months had a wheezing attack severe enough to limit speech. All these parameters of asthma severity were quite similar in both sexes, except for the bad attacks where the girls tended to have these more

often, even if this difference just missed statistical significance (24.8% vs 18.6%, $P = 0.06$). Only 11.1% of the participating children had been labelled as asthmatic; 20.6% had exercise-induced wheezing and this was quite specific to wheezers 'ever' ($P < 0.0001$) and current wheezers ($P < 0.0001$), when these were compared with non-wheezers. Night-time cough was a more common symptom, and although not as specific to the cumulative group of wheezers, it was experienced by more children who also wheezed in the past twelve months than those who did not ($P < 0.0006$). More girls had a dry nocturnal cough in the absence of an infection (35.5% vs 27.6%, $P < 0.0001$) than boys.

Effect of multiple variables on asthma prevalence and symptoms (Table 3)

Of wheezers, 76.5% 'ever' had an atopic relative while only 57.9% of non-wheezers had one ($P < 0.0001$). The same applied to current wheezers (59.4% vs 50.2%, $P < 0.02$). Wheezers who had an atopic relative were more prone to have exercise-induced symptoms ($P < 0.0001$), nocturnal cough ($P < 0.0001$) and be labelled as asthmatic ($P < 0.0001$).

There were 13.4% of all participants who were personal smokers, with both genders being fairly equal (12% of boys and 14.7% of girls). However, whereas boys from private schools were more often smokers than state school boys (22.5% vs 12%, $P < 0.004$), the reverse situation was present for girls (13.9% vs 1.7%, $P < 0.0002$). Some 42.4% of smokers had wheezed some time in their life while only

Table 2. Severity of symptoms expressed as % of respondents with current symptoms of allergic condition

	Total (%)	Boys (%)	Girls (%)
Severity of wheezing			
1–3 wheezing attacks in last 12 months	68	67.6	68.3
4–12 wheezing attacks in last 12 months	19.7	16.7	22.3
> 12 wheezing attacks in last 12 months	8.5	9.8	7.4
Sleep never disturbed by wheezing	57.8	61.4	54.8
Sleep disturbed by wheezing < 1 night a week	25.3	20.9	28.9
Sleep disturbed by wheezing > 1 night a week	15.1	14.7	15.4
Severe asthmatic episodes in last 12 months	22	18.6	24.8
Severity of rhinitis			
Did not affect daily activity	31.8	35.2	40.2
Daily activity affected a little	43.2	46.5	40.9
Daily activity affected moderately	13.7	11.2	15.4
Daily activity affected a lot	2.9	3	2.8
Severity of itchy rash			
Rash never keeps child awake	55	57.1	53.7
Rash keeps child awake < 1 night a week	25.4	23.3	26.6
Rash keeps child awake > 1 night a week	14.9	12.9	16.2

24.4% ($P < 0.005$) of the non-smokers did. The smokers were also more likely to persist in wheezing ($P < 0.005$), have night-time coughing ($P < 0.0001$), have exercise-induced wheezing ($P < 0.03$) and be diagnosed as asthmatic ($P < 0.001$). Although there was a very strong trend towards smokers having bad wheezing attacks more often than non-smokers, this did not reach statistical significance ($P = 0.06$).

Out of the total number of respondents, 2389 (57.1%) were passive smokers. In 1644 of the cases the child's father smoked, in 861 cases it was the mother who smoked while a brother or a sister smoked in 263 and 129 cases respectively. Wheezers were not more likely to be passive smokers than non-wheezers, but children with exercise-induced wheezing ($P = 0.03$) or night-time coughing ($P = 0.0001$) were more likely to be exposed to smoking in their household.

Children who lived in roads which they described as being busy with passing traffic were more often one-time wheezers than those living in quiet roads. The current wheezers living in these busy roads experienced nocturnal cough more often ($P < 0.0001$).

Wheezers 'ever' were less likely to have blankets in their bedroom ($P < 0.0001$) or pets in their house ($P < 0.05$) than non-wheezers. Diagnosed asthmatics also had blankets less often on their beds than children who had never been labelled as asthmatic ($P < 0.001$).

Although the absolute number of participating students attending private schools was small when compared with that from state schools, as a percentage these children had a

higher rate wheeze 'ever' ($P < 0.002$). However, they did not wheeze more often in the past 12 months.

The Maltese Islands had a higher cumulative (27.9% vs 23.8%) and current (16% vs 14.2%) [6] prevalence rate of wheezing when compared with the global mean for this age group. However, we had a slightly lower rate than the worldwide mean for self-reported or diagnosed asthma (11.1% vs 11.7%)

Responses to the Rhinitis questionnaire (Tables 1 and 2)

Of all respondents, 52.7% had nasal problems in the absence of a cold or the flu at one time in their life while 47.4% had experienced these symptoms in the previous 12 months. The females were more likely to have rhinitis 'ever' (55.7% vs 49.2%, $P < 0.0001$) and were more likely to have persistent symptoms ($P < 0.0001$) and accompanying itchy/watery eyes ($P < 0.0001$). These nasal problems did not interfere with daily activities of 31.8% of sufferers, a little in 43.2%, to a moderate degree in 13.7% and considerably in only 2.9%, 32.3% of the participating children had been labelled as suffering from hay fever, with the girls more likely to receive this diagnosis. The nasal symptoms had a seasonal variation in all but 15.5% of the total participants, who had perennial symptoms. Seasonal symptoms peaked in February/March/April when around 40% of respondents had their symptoms, and were least prevalent in summer and then started to increase again in September (Fig. 1)

Table 3. Effects of multiple variables on the reported symptoms and diagnosis of Asthma, Rhinitis and Eczema

	Female sex	Personal smoking	Passive smoking	Busy Road	Pets	Atopic relative	Blankets
Wheeze 'ever'	NS	2.15*** (1.78–2.6)	NS	1.15* (1.0–1.32)	0.83* (0.7–0.99)	2.36*** (2.02–2.77)	0.89* (0.70–0.97)
Wheeze 12 mths	1.26* (1.0–1.6)	1.48** (1.09–2.02)	NS	NS	NS	1.51** (1.14–2.01)	NS
Nocturnal wheeze	NS	NS	NS	NS	NS	NS	NS
Bad attack	NS	NS	NS	NS	NS	NS	NS
Exercise-induced Wheeze	NS	2.12*** (1.73–2.59)	1.18* (1.01–1.39)	1.18* (1.01–1.38)	NS	2.28*** (1.90–2.73)	NS
Cough 12 mths	1.36* (1.18–1.56)	2.51*** (2.08–3.03)	1.33*** (1.16–1.52)	1.3*** (1.14–1.49)	NS	1.81*** (1.56–2.10)	NS
Diagnosed Asthma	NS	1.46** (1.12–1.91)	NS	NS	NS	3.70*** (2.81–4.80)	0.66** (0.53–0.83)
Rhinitis 'ever'	1.30*** (1.15–1.47)	1.95*** (1.61–2.37)	1.13* (1.0–1.28)	NS	NS	2.37*** (2.07–2.71)	NS
Rhinitis 12 mths	1.97*** (1.48–2.62)	NS	NS	NS	NS	1.94*** (1.45–2.61)	NS
Itchy eyes	1.91*** (1.58–2.30)	1.29* (1.0–1.66)	NS	1.4** (1.16–1.68)	NS	1.87*** (1.51–2.31)	NS
Diagnosed Hayfever	1.49*** (1.31–1.71)	NS	NS	NS	NS	3.34*** (2.84–3.91)	0.74** (0.63–0.87)
Itchy rash 'ever'	1.36** (1.13–1.65)	1.59** (1.24–2.03)	NS	NS	NS	1.50*** (1.22–1.85)	NS
Itchy rash 12 mths	NS	NS	NS	NS	NS	2.36*** (1.5–3.71)	NS
Diagnosed Eczema	6.46** (4.68–8.95)	2.01** (1.52–2.65)	NS	1.26* (1.01–1.57)	NS	2.73*** (2.06–3.64)	NS

Adjusted odds ratios (95% confidence interval) * $P < 0.05$, ** $P < 0.001$, *** $P < 0.0001$, NS, not statistically significant.

Effect of multiple variables on rhinitis prevalence and symptoms (Table 3)

Children who had suffered from nasal problems were more likely to have an atopic relative ($P < 0.0001$) and the same applied to current rhinitics ($P < 0.0001$). Rhinitics who had an atopic relative were more prone to have accompanying itchy and watery eyes ($P < 0.0001$).

Personal and passive smokers were also more likely to have suffered from nasal problems ($P < 0.0001$) than non-smokers. The personal smokers also experienced itchy eyes more often ($P < 0.05$). Children who lived in roads which they described as being busy with passing traffic were only more affected as far as the eyes were concerned ($P < 0.001$). Pets in the house and soft furnishings in the bedroom had no effect on rhinitis according to our figures.

The Maltese Islands had a higher cumulative (52.7% vs 37.2%) and current (47.4% vs 29.2%) prevalence rate of

rhinitis [7] when compared with the global mean for this age group. We also had a higher rate than the worldwide mean for self-reported or diagnosed hay fever (32.2% vs 18.8%).

Responses to eczema questionnaire (Tables 1 and 2)

Of all respondents, 12.8% had current itchy rash which was coming and going for at least 6 months sometime in their lives while 10.1% were still getting such a rash in the last 12 months. The females were more likely to have this rash 'ever' (14.4% vs 10.9%, $P < 0.001$) and were more likely to have persistent symptoms ($P < 0.001$). 76.5% of children with a current itchy rash had involvement of areas of their body which are usually quite typically affected by eczema and 57.1% of these current sufferers said that their rash cleared some time during these last 12 months. The sleep of

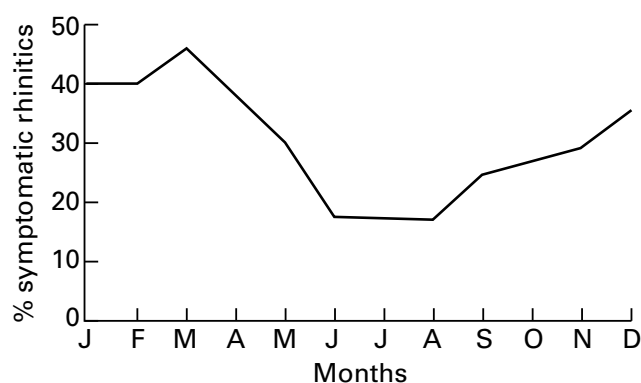


Fig. 1. Seasonal variations of rhinitis symptoms.

55% of the current rash sufferers was never disturbed by itching, but 25.4% had nocturnal symptoms less than one night per week and 14.9% were awakened one or more nights a week. Only 8.8% of the participating children had been labelled as having eczema with the girls at 14.2% and the boys at 2.4% ($P < 0.001$).

Effect of multiple variables on eczema prevalence and symptoms (Table 3)

Children with an atopic relative had a higher cumulative ($P < 0.0001$) and current prevalence of itchy rash. They were also labelled as having eczema more often ($P < 0.0001$).

Personal smokers were more likely to have had a recurrent itchy rash some time in their life ($P < 0.001$) but not to experience this rash at the present time. Eczema prevalence and symptoms were not affected by the indoor pollutants produced by passive smoking, pets or soft furnishings. The only way living in a busy road did have an effect on this condition was that there was a significant higher number of children diagnosed as having eczema living in such roads.

The Maltese Islands had a slightly lower cumulative (12.8% vs 13.6%) and an almost identical current (10.1% vs 10.2%) prevalence rate of itchy rash [8] when compared with the global mean for this age group. However, we had a slightly higher rate than the worldwide mean for self-reported or diagnosed eczema (8.8% vs 6.5%).

The presence of more than one allergic condition per child

Whereas 74.3% of wheezers 'ever' suffered from rhinitis only 44.3% of non-wheezers did so ($P < 0.0001$). In the case of current wheezers, 78.6% of them had nasal problems while 69.4% of non-wheezers in the last year had similar problems ($P < 0.0002$); 20.1% of one time wheezers had an itchy rash coming and going for at least 6 months compared

with 10% of non-wheezers ($P < 0.001$); 17.9% ($n = 209$) of wheezers 'ever' had one of the three allergic conditions studied, that is asthma, hay fever and eczema, some time in their life.

Discussion

This set of data for the 13–15-year-olds clearly demonstrates that allergic conditions are a common problem among Maltese children. It is felt that the data obtained from this age group are very relevant as the subjects were answering the questionnaires themselves, thus supplying us with direct information of prevalence and severity of symptoms and also with information about associated risk factors. The strong response rate (88.7% of randomly sampled children) adds strength to the figures obtained.

The cumulative prevalence of wheezing at some time in the subject's life in this group (27.9%) was higher than our expectations. The global mean cumulative prevalence was 23.8% and this group of Maltese schoolchildren surpass this quite substantially [5,7]. The fact that more than half of these children (57.2%) were still wheezing in the past 12 months shows that asthma is quite a persistent condition and that the popular idea that the majority of children 'outgrow' their asthma in their teenage years is not corroborated in this large cohort. This persistence of wheezing into adolescence is significantly more common in girls (60.2%) and this is in agreement with other past studies [9] which showed a higher rate of asthma in the female sex in this age group. The reason for this difference with gender is still unknown though hormonal changes seen in the female sex during puberty have been cited.

When the severity of wheezing in current wheezers was assessed by the number of wheezing attacks and sleep disturbance due to nocturnal wheezing, one could note that 8.5% of current wheezers had more than 12 wheezing episodes in the past 12 months and 15.1% woke up wheezing more than one night a week. Thus, in spite of modern asthma therapy, bronchial asthma is still not adequately controlled in a good number of patients. In fact 22% of our current wheezers had episodes bad enough to limit speech and therefore severe enough to be life-threatening. Although not statistically significant, the females again fared worse with a strong trend ($P = 0.06$) towards more severe episodes than their male counterparts.

The number of children who were aware that they were diagnosed as having asthma lagged well behind the cumulative prevalence of wheezing and although this might be partly explained by other causes of wheezing apart from asthma, the most likely explanation for most of this deficit is under-diagnosis of the condition or failure to apply the diagnostic label of 'asthma'. This deficiency stems from

not recognizing atypical or less common presentations of the condition such as cough and symptoms suggestive of bronchial hyperreactivity, and from a reluctance in labelling a child as suffering from asthma. Although both the Maltese cumulative and current prevalence rates of wheezing are higher than the global mean, we lag behind in the rate of diagnosed asthma. This suggests that there was a trend to manifestly diagnose this condition quite a lot less than other countries, considering the higher numbers of wheezers seen by Maltese doctors.

Apart from the ISAAC core questions a few simple 'local' questions were added to try and detect any associations with wheezing and which could hopefully lead to more detailed local studies of the factors which proved to be the most relevant, in the future. As in the case of other studies, the children with a history of past or current wheezing were more likely to be related to someone with a history of an atopy-based condition. This adds fuel to the current view that the genetic influences are very strong in allergic disorders. The relatively closed Maltese society inevitably results in some degree of intermarriage and inbreeding which leads to a situation where genetic elements could be strongly expressed. This could partly explain the high prevalence of these allergic conditions in childhood in the Maltese islands.

It was disappointing to note that as much as 13.4% of 13–15-year-old Maltese schoolchildren smoke cigarettes, with the girls equalling the boys in this respect. These figures for total and gender prevalence of smoking are very close to those acquired in similar surveys in the UK [10] and other countries [11]. Although the written question did not enquire about smoking frequency, the children were made to understand that the question did not concern smoking the occasional cigarette. Regular smoking in children is defined in other studies as being at least one cigarette per week [12]. The validity of self-reported data on smoking might be questioned because of the possibility of under-reporting, because of fear of parental reprisal, or alternatively, over-reporting to boast. To decrease the chances of these eventualities, prior to handing out the questionnaires we assured the participating students that their answers will be absolutely confidential. Furthermore, McNeil *et al.* [13] demonstrated that self-reports on smoking by adolescents matched cotinine levels in their saliva in 99% of cases, thus proving them to be reliable research tools. In the present study wheezing sometime in the past or current wheezing were much more common in smokers than non-smokers and this could mean that personal smoking was a major risk factor for the occurrence and persistence of wheezing. In fact the Maltese wheezers who smoked were more prone to continue wheezing into their adolescence than those wheezers who did not smoke. They also tended to be awakened more often with coughing and wheezing and were more

likely to experience exercise-induced cough. The possible mechanism for all this could be either a direct pro-inflammatory and irritant effect on the airway mucosa by the inhaled smoke and toxins and/or the induction of an increase in the expression of atopy in susceptible subjects by smoking [14,15]. This association between smoking and wheezing is in concordance with other studies where asthma was shown to be more common in children who smoked [16] and that asthma was more problematic in adolescent smokers [17–19]. Only 15% of personal smokers were also passive smokers and the latter seemed to be more affected in the way of nocturnal cough and exercise-induced wheezing than children who were not exposed to environmental tobacco smoke in their household. An emphasis on anti-smoking campaigns aimed at young people of this age group, is justified by findings from other investigators that it is at this age that the greatest age-related increase in smoking prevalence takes place and that the majority of adult daily smokers would have started the habit in adolescence [20].

Other possible factors encountered in the indoor environment were addressed when the children were asked whether they kept any birds or animals in the house and any soft toys, blankets or thick carpets in their bedroom. Surprisingly, those children who owned a pet or had a blanket in their bedroom had a lower cumulative rate of wheezing than children who did not. There was no difference in use of soft toys or thick bedroom carpets between wheezers and non-wheezers. This probably signifies that parents of asthmatics are attempting to decrease the load of house dust mite in their child's bedroom through utilising other bed coverings than blankets, which are usually made of fabrics which tend to collect a lot of dust and mites. This important allergen [21] is very common in our houses because of the hot and humid Maltese climate, however this same climate precludes the common use of thick carpeting in bedrooms in most houses, thus eliminating an important breeding place for house dust mite [22]. Although most doctors do advise their patients not to have furry animals or birds in the house of asthmatic children it sometimes proves quite difficult to persuade the children or the parents to get rid of a precious pet. However, it does seem that many Maltese parents are heeding this medical advice. The literature seems to point most importance to removing cats as pets in asthmatics' homes as it seems their dander is more allergenic than that of other domestic animals, especially if encountered in the first months of life [22,23]. If one had to analyse all these data together, cigarette smoke does seem to be the indoor pollutant that is causing most strife to Maltese asthmatics as it is the only factor studied that is more commonly encountered in the houses of asthmatic children as compared with non-asthmatics.

Children who stated that their residence was situated in a

road which was busy with traffic were prone to be diagnosed as asthmatic more commonly than their colleagues who lived in quieter areas. These children experienced severe asthmatic attacks and nocturnal coughing more often as well. The association between outdoor pollution and asthma is mentioned in a lot of current research articles regarding possible contributing factors to the development and persistence of the respiratory affliction [24,25]. There have been a lot of conflicting results from different studies with temperature, sunlight, humidity and other climatic factors acting as confounding factors which confuse the study results and decrease the possibility of determining a strong direct relationship between outdoor pollution and asthma [26]. However, when one considers most of the evidence of the deleterious effect of particulate matter [PM₁₀], nitrogen dioxide, sulphur dioxide, ozone and other outdoor pollutants on the respiratory mucosa, the likelihood that pollution at least worsens the asthmatic state is very tenable [27]. The figures above certainly point to car tail-pipe emissions in the relatively narrow Maltese streets contributing to wheezing in young adolescents. The lack of catalytic converters, formal testing for car tail-pipe emissions and the popular use of diesel and leaded petrol in our country are likely to be involved in this aspect as well.

The socio-economic differences in wheezing rates was addressed in a roundabout way by assuming that children attending fee-charging private schools, came from well-to-do families. Although the numbers of participating students in the three randomly chosen private schools ($n = 271$) were much smaller than those sampled in state schools ($n = 3913$), one could observe a clear difference in prevalence rates of all allergic conditions studied between the two types of schoolchildren. Private school students were much more likely to wheeze and experience nasal problems than state school students. The differences in the occurrence of itchy rashes were smaller but still more common in children studying private schools. These children also tended to continue wheezing into puberty and experience severe asthmatic episodes more often. Another interesting observation was that although the total rate of personal smoking in both types of schools was similar, there was a big gender-related difference. Whereas the girls in state schools smoked substantially more than private school girls the reverse situation was noted in the two sets of males. Whether these differences are due to the probable socio-economic distinctions remains to be further studied in the future. A recent study from Singapore utilizing the ISAAC questionnaire, also showed a higher prevalence of asthma among children coming from a higher socio-economic group [28]. Other investigators found no such difference [29,30] but clinical manifestations, hospitalisation and school absenteeism tended to be higher in the lower socio-economic classes [31–33].

Problems with the nose in the absence of an infection seemed to be an even more common problem than wheezing, in our students. In fact the ISAAC data analysis centre in New Zealand noted that Malta has the second highest cumulative prevalence rate of rhinitic symptoms among the big number of worldwide ISAAC centres. Contrary to the wheezing questionnaire, the Maltese tended to also have quite a high rate of diagnosing a good number of these cases as hay fever. Again, in this age group the girls seemed to suffer more often and persistently than the boys. There was a seasonal variation in symptoms with most cases being at their worst the February to April period. They improved during summer and restarted experiencing symptoms in the autumn. This seasonal pattern is very supportive of an allergic cause to most of these rhinitic symptoms and is probably due to a combination of increased pollen counts and the prevailing weather conditions during the time of year in question. Around 15% of all respondents had perennial nasal symptoms.

Interestingly, as in the case of asthma, personal smokers were again affected more often than non-smokers. The smoking students had a higher cumulative prevalence of rhinitis and also of accompanying itchy and watery eyes. These could be due direct irritation of the nasal and conjunctival mucosa or an increase in susceptibility of expression of allergy in smokers. Passive smokers were also affected adversely with higher rhinitis 'ever' rates.

An itchy rash which was coming and going for at least 6 months which was meant to be suggestive of eczema was the least commonly occurring of the three allergic conditions investigated in this study. The Maltese cumulative prevalence was just slightly less than the global mean while the current prevalence was exactly the same [8]. Eczema in these children was diagnosed slightly more often than the worldwide average, which was contrary to the case in allergic rhinitis and asthma. It was again the female sex that suffered more from this condition in this age group and who were more likely to be labelled as suffering from eczema. The girls' rate of self-reported eczema was almost exactly the same as their cumulative rate of itchy rash 'ever' while there was quite a difference between the two indices for the male sex. One can speculate that in girls most itchy rashes were labelled as eczema or else that the female responders in our study were more precise in answering these questions. The majority of children with a current history of itchy rash (76.5%) had involvement of areas in their body such as flexural areas and around ears and eyes by this rash; a pattern which is very typical of eczema. This is very supportive of a diagnosis of eczema in most of these children with an itchy rash. Just under half of the current rash sufferers (42.9%) noted that their rash did not clear at any time in the last year, suggesting a degree of chronicity to their condition. Both sexes seemed to have the

4 In which of the past months did the nose problem occur?
(Please tick any which apply)

January	[]	May	[]	September	[]
February	[]	June	[]	October	[]
March	[]	July	[]	November	[]
April	[]	August	[]	December	[]

5 In the past 12 months, how much did this nose problem interfere with your daily activities?

Not at all	[]
A little	[]
A moderate amount	[]
A lot	[]

6 Have you ever had Hayfever? Yes []
No []

1 Have you ever had an itchy rash which was coming and going for at least six months? Yes []
No []

If you have answered 'No' please skip to Question 6

2 Have you had this itchy rash at any time in the last 12 months? Yes []
No []

If you have answered 'No' please skip to Question 6

3 Has this itchy rash at any time affected any of the following places: Yes []
No []
the folds of the elbows, behind the knees,
in front of the ankles, under the buttocks,
or around the neck, ears or eyes?

4 Has this rash cleared completely at any time during the last 12 months? Yes []
No []

5 In the last 12 months, how often, on average, have you been kept awake at night by this itchy rash?
Never in the last 12 months []
Less than one night per week []
One or more nights per week []

6 Have you ever had eczema? Yes []
No []

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